

the month. Prof. Gustavus Hinrichs, of Iowa City, Iowa, observed the sun's disk on fourteen days, but saw no spots. Observations were also continued at Fort Whipple, Va., but no spots reported.

## NOTES AND EXTRACTS.

Dr. Köppen, of the *Deutsche Seeverte*, publishes the following note on the mean pressure of the atmosphere in the interior of Asia: "The two most important features in the geographical distribution of the mean pressure of the atmosphere are, first, the maximum which through the whole year lies in the neighborhood of 30° to 35° north (and south) latitude on the oceans and the west coasts of the continents; and, 2nd, the inverse relations of the continents and oceans of the temperate zones, especially the winter maximum of pressure in the interior of the continents. While there is little difficulty in determining the details of the first-named feature, since it comes directly to the knowledge of every observing navigator and without further discussion of his observations, although its theoretical explanation still leaves much to be desired—yet in respect to the the second feature it is quite the reverse. The origin of this feature is easily understood as due to the great contrasts of temperature between the continents and neighboring oceans. For 40 years it has been known that the barometric pressure in southern Siberia averages twenty millimeters and more, less in summer than in winter. But on account of the entire absence of measures of altitude in Siberia, determined independently of atmospheric pressure, it was not possible to accurately determine the differences in the pressure in the interior and on the coasts, or to reduce the pressure in the interior to sea-level. This uncertainty has lately been removed by the results of the Levelling Expedition conducted eastward to the sea of Baikall, at the suggestion and under the direction of the Imperial Russian Geographical Association. Some of these results have been published by Woeikof, and show that all previous assumptions as to the high pressure in winter in southern Siberia, were considerably below the truth. Thus, the normal pressure for January, in the region east of Lake Baikall, becomes 778 millimeters, (30.63 inches,) or higher than any where else outside of Asia; and individual maxima above 800 millimeters, (31.50 inches,) frequently occur.

A *Magnetic Storm* occurred May 14th, of which accounts have been published from various stations where regular recording instruments are kept in action. It began as shown in the following table, where the times are reduced to Greenwich:

Name.	Date.	Declination.	Horizontal Force.	Vertical Force.
Greenwich.....	14th.....	6 h. 5 m., a. m..	.....	.....
Stonyhurst.....	„ .....	6 h. 4 m., a. m..	.....	.....
Zikawei.....	„ .....	6 h. 4 m., a. m..	.....	.....
Melbourne.....	„ .....	6 h. 20 <sup>9</sup> m., a. m..	.....	.....
Madison, Wis.....	„ .....	5 h. 58 m., a. m..	6 h. 3 m., a. m....	7 h. 8 m., a. m....

It is not stated how much the sluggishness of the recording magnet, or other instrumental error, may have affected these figures, but it is evident that the disturbance was nearly simultaneous throughout the world, and that any investigation into the origin of such disturbances will require the use of apparatus that will record to seconds of time rather than to minutes.

*Observations of Temperature at Distant Places.*—The following apparatus is adopted for keeping a record not only of underground temperatures, but by a slight modification it allows of observing the temperature of the air at points upon mountain-tops or in stationary balloons:

Several instruments have been contrived which, when buried in the earth, with wires coming from them to the surface, admit of having their temperatures observed by electrical means.

One of these is Siemens' resistance thermometer, another is Wheatstones telegraphic thermometer, of which a description will be found in the Report of the Dundee Meeting of the British Association; another is Becquerel's thermo-electric apparatus, which has been employed by its inventor and his son and grandson for some forty years. It is described in the following terms in the first Report of this Committee (1868):

"The thermo-electric method might also be followed with great advantage. Two wires, one of iron and the other of copper, insulated by gutta-percha or some other covering, as in submarine cables, and connected at their ends, might be let down so as to bring their lower junction to the point where the temperature is to be taken, their upper junction being immersed in a basin of water, and the circuit completed through a galvanometer. The temperature of the water in the basin might then be altered till the galvanometer gave zero indication."

Sir Wm. Thomson now adds the recommendation that, in carrying out this method, the two wires, each well covered with gutta-percha, should be twisted together; that the wires should be stout and as homogeneous as possible throughout, and that a piece of stout copper tube should be attached to the lower junction, this tube being uncovered and in close contact with the earth all round, its purpose being to insure that the junction takes the proper temperature,

It would probably be desirable, in filling up the bore, to mix clay with the original material to render it watertight, for it would be impossible to render the filling of the bore as compact as the surrounding rock.

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Several pairs of wires would be buried in the same bore, with their lower junctions at different carefully-measured depths.

The upper junctions would be kept in a room provided with a steady table for a mirror-galvanometer.

*Rain-fall.*—A steady decrease in the depth of water in the upper portions of the Amazon has been observed of late years, so that navigation is sometimes impeded. It is suggested that this must be due to a general diminution of rain-fall in the interior of South America, such as has been observed in other countries in connection with cosmic-phenomena.

*Barometer.*—John Allan Broun communicates to *Nature* an extract from a forthcoming work on the diurnal oscillations of the barometer. Having carefully examined the law of these oscillations at Makerston, Dublin, Greenwich and Brussels, he concludes that the semi-diurnal oscillation is due to a cosmic cause, independent of local influences, while the diurnal oscillation shows that part of the solar action which is modified by atmospheric conditions not yet determined. The semi-diurnal oscillation is due to an action of the sun, which is repeated equally twice in each day like the solar oceanic-tide. The instrumental errors arising from unknown errors in the temperature and co-efficient of expansion of the mercury and brass and from other sources indicated by Wild, are apparently briefly referred to, and are probably quite sensible in amount and systematic periodicity in the four series here discussed.

*Arctic Meteorology.*—Lieutenant Weyprecht and Count Wilczek propose to spend at least one year in physical observations in Nova Zembla, or some other point on the north coast of Europe or Asia, and invite others to make similar observations simultaneous with their own.

The general results of the observations made by Mr. O. T. Sherman of the Howgate Expedition to Annanatook (latitude  $66^{\circ} 13' 45''$ , longitude  $67^{\circ} 18' 39''$  W.) are given in the following table:

DATE.	BAROMETER REDUCED TO SEA-LEVEL.	TEMPERATURE.			SEA-WATER TEMPERATURE.		PRECIPITATION. Inch.	WIND.		CLOUDINESS.
		Max.	Min.	Mean.	Surface.	18 feet below.		Prevailing.	Mean h'ly velocity.	
1877—September .....	29.706	47.0	+26.0	+37.0	35	—	8.88	NW	5.5	0.89
October .....	29.743	36.2	+ 4.0	+22.8	30.0	—	1.07	NW	7.0	0.80
November .....	29.773	28.0	-10.0	+ 7.3	28.8	—	1.04	W	12.6	0.71
December .....	29.573	21.5	-41.0	-11.8	27.3	—	0.98	W	9.0	0.49
1878—January .....	29.695	21.5	-49.5	-17.6	28.2	—	0.5	W	4.2	0.44
February .....	29.724	11.5	-42.6	-18.0	29	29.2	0.49	W	3.3	0.65
March .....	29.823	35.8	-46.0	-13.7	—	—	0.5	W	4.8	0.62
April .....	29.803	35.4	-14.0	+10.4	—	—	0.77	W	6.7	0.60
May .....	29.861	48.5	- 8.0	+25.6	20	29.5	1.18	SE	6.2	0.76
June .....	29.790	55.3	+18.0	+34.9	31.8	31.1	1.85	W	6.6	0.79
July .....	29.763	62.8	+34.0	+40.0	38.2	32.4	4.18	SE	16.6	0.77
August .....										

*Atmospheric Electricity.*—The following extract from a memoir by Prof. J. D. Everett, of Belfast, presents views held by eminent electricians:

1. In discussions relating to the electrical condition of the air at a specified point, three things must be carefully distinguished: electrical density, electrical force, and electrical potential.

(a.) The electrical *density* at a point in the air is the quantity of electricity, per unit volume, with which the air at the point is charged.

(b.) The electrical *force* at a point is the force with which a unit of positive electricity would be acted on, if brought to the point without altering, by its inductive action, the previously existing distribution.

(c.) The electrical *potential* at a point is the work which would be done by electrical force upon a unit of positive electricity passing from the point to the earth, the movement of this unit being supposed not to disturb the pre-existing distribution.

2. Suppose an insulated conducting disc, several yards in diameter, to be fixed at the distance of one yard from a perfectly level surface forming part of the earth. Let the disc receive a positive charge, the intervening air being uncharged. Then the state of this intervening air, as regards the three particulars above distinguished will be as follows:

(a.) The electrical density will be zero at all points of it.

(b.) The electrical force at all points of it will be finite, and will be directed from the disc toward the earth.

(c.) The electrical potential will be nearly zero at points very near the earth, and will increase in approaching the disc, its value at points very near the disc being nearly as great as the potential of the disc, which is a constant quantity for all parts of the disc.

3. The electrical force will be nearly constant over all the region considered, except the circumferential portion. Leaving the circumferential portion out of account, and therefore regarding the force as constant, the potential at any point will be equal to the product of the force by the distance of this point from the surface of the earth; and the potential of the disc will be equal to the product of the force by the distance between the disc and the earth.

4. The general proposition, of which this is a particular case is that if we travel along a line of force from any point A to any other point B, the product of the mean force by the distance travelled is equal to the difference of potentials of A and B.

5. The definition of potential above given (1. (c.)) tacitly assumes the potential of the earth to be zero. Strictly speaking, we have no knowledge of absolute potential, but only of difference of potential.

6. In observations of atmospheric electricity, the element directly observed is potential,—the potential at a point in the air.

7. Instruments for the observation and measurement of potential are called *electrometers*, which are described in the *Annuaire de la Société Météorologique de France*, Vol. XXV, 1877, containing a comprehensive article on atmospheric electricity by M. Alfred Angot, entitled *L'Électricité atmosphérique, d'après les travaux de Sir W. Thomson et la Conférence de M. Mascart*.

8. In every electrometer, the potential which is directly measured is that of a certain insulated conductor forming part of the instrument. In order to measure the potential at a point in the air, we must first reduce this conductor to the potential which exists at that point. The apparatus for attaining this end is called a *collector*.

9. The most efficient collectors act by convection. A rapid discharge of matter is caused to take place from a projecting portion of an insulated conductor, and the matter, as it passes off, carries electricity with it until electrical equilibrium is attained.

10. In Sir William Thomson's water-dropping collector, a fine stream of water issues from the end of a long pipe; and the point in the air whose potential is attained is the point where the water ceases to be a continuous stream, and begins to be a succession of detached drops.

11. When a flame, or a discharge of hot smoke, is employed to collect electricity, the potential attained is that of the region where the hot gases have become just cool enough to lose their conducting power; for hot gas is a conductor, and cold gas is a non-conductor.

Sir William Thomson employs, in connexion with his portable electrometer, matches formed of blotting paper, steeped in nitrate of lead, dried, and formed into rolls with the aid of a little gum. They burn without flame, and are not extinguished by rain.

12. Some observers, notably Peltier, Quetelet, and Dellmann have adopted an altogether different mode of observing. Instead of observing the potential at a point in the air, they have observed the density of the electricity residing on an exposed conductor connected with the earth, or, to put the matter more simply, they have observed the charge residing on the earth's surface.

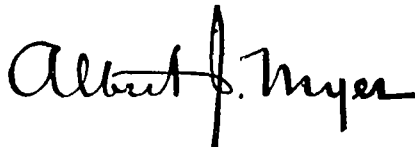
13. The theoretical connexion between the two modes of observation is as follows:—

Suppose a large open and level area on the earth's surface to be uniformly electrified. Then the lines of electrical force over this area will be vertical up to a considerable height, and the intensity of the force will be sensibly uniform at all heights, up to that at which the charge of electricity in the air beneath is of sensible magnitude in comparison with that on the surface of the earth. For, if we consider the space bounded by a vertical cylindrical tube of unit section, the charge residing on that portion of the earth which forms the base of the tube, together with the charge in the air within the tube up to any height, is equal to the force at this height, divided by 4. If the force is uniform, the potential at any height is the product of the force by the height (Art. 3). The potential at a given point in the air near the earth will therefore vary directly as the charge on the earth's surface beneath it. The signs of these two quantities will, however, be opposite. If the charge on the earth's surface be negative, as is usually the case, the potential in the air will be less strongly negative, or more strongly positive than that of the earth, and is therefore to be reckoned positive when we assume the potential of the earth as zero.

14. The effect of irregularities on the earth's surface, including under the name "earth" trees, buildings, and all other conductors in communication with the ground, is to make the distribution of electricity over the surface unequal, in accordance with the law that the density is greatest on the projecting parts of a conductor. The potential at a given distance from the surface, if this distance is not too great, will be nearly proportional to the density, and will therefore be greatest over the projecting parts.

15. Some observers have employed a pointed conductor for collecting atmospheric electricity. In theory, an infinitely sharp point could retain no charge, and would therefore reduce the conductor to which it belongs to the potential of the air close to the point; but actual points fall short of attaining this end by sensible and uncertain amounts. A pointed collector cannot now be regarded as a scientific instrument.

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